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Development of automated test system for diesel engines based on fuzzy logic

Galiullin L.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2016 IEEE.To control a diesel engine during testing, the principles of fuzzy output, which are widely used in fuzzy-logic controller development, could be applied. The controller's main task is to monitor an external object, in which case the behavior of the monitored object is described with the fuzzy rules. The most important application area of the fuzzy set theory is the fuzzy logic controllers. Their operation slightly differs from the operation of common controllers. In order to describe the system, the expert knowledge is used instead of differential equations. Control of the automation systems for engine testing (AST) with the fuzzy-logic controller should be based on a knowledge database with fuzzy rules. Such database could be created with expert knowledge, neural network, or direct measuring method. Development of an adaptive control system for diesel engine testing process based on the fuzzy logic enables simplification of the system's structural components and provision of discrete control procedure with some uninterruptible properties, which could improve the control and reduce the scope of the knowledge database. Fuzzy logic makes it simple to input a priory information about an object in the form of fuzzy control rules into the adaptive control system. Similarity of form and natural language relatively easy allows obtaining necessary expert knowledge. A prior information provides one of the key initial conditions of the system developed according to adaptive control method-the condition of supreme initial adaptation.

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Keywords

database, diesel, fuzzy, system, test

References

[1] C. Wang, S. Xu, "Study on the engine test and fault diagnosis system based on the information fusion technique, " in Proc. ICCSE 2011-6th International Conference on Computer Science and Education, Final Program and Proceedings, 2011, art. no. 6028849, pp. 1208-1210, 2011.

[2] D. Wang, M. Li, C. Liu, J. Sun, "Fault diagnosis of automobile engine based on support vector machine, " Applied Mechanics and Materials, 80-81, pp. 1060-1064, 2011.

[3] E.V. Zubkov, L.A. Galiullin, "Hybrid neural network for the adjustment of fuzzy systems when simulating tests of internal combustion engines, " Russian Engineering Research, 31(5), pp. 439-443, 2011.

[4] L. Cheng, Y. Zhang, Z. Li, G. Ren, J. Li, "Diesel engine online monitoring based on smart order tracking sensor system, " in Proc. 3rd International Conference on Measuring Technology and Mechatronics Automation, ICMTMA, 2011, 1, art. no. 5720973, pp. 1079-1082.

[5] L.A. Galiullin, "Automated test system of internal combustion engines, " in Proc. IOP Conference Series: Materials Science and Engineering, 2015, 86 (1), art. no. 012018, pp. 1-6.

[6] K.L. Fang, W. Zhe, Z. Wei, "ANFIS-based fault diagnosis cloud model of oil parameter for automobile engine, " in Proc. 2011 International Conference on Mechatronic Science, Electric Engineering and Computer, MEC, 2011, art. no. 6025990, pp. 2458-2462.

[7] R.L. Biktimirov, R.A. Valiev, L.A. Galiullin, E.V. Zubkov, A.N. Iljuhin, "Automated test system of diesel engines based on fuzzy neural network, " Research Journal of Applied Sciences, 9(12), pp. 1059-1063, 2014.

[8] E.V. Zubkov, A.A. Novikov, "Regulation of the crankshaft speed of a diesel engine with a common rail fuel system, " Russian Engineering Research, 32(7-8), pp. 523-525, 2012.

[9] R.A. Valiev, A.Kh. Khairullin, V.G. Shibakov, "Automated Design Systems for Manufacturing Processes, " Russian Engineering Research, 35(9), pp. 662-665, 2015.

[10] W. Zhang, J. Zhu, L.F. Kong, "Gradient genetic algorithm-based performance fault diagnosis model, " in Proc. 2011 2nd International Conference on Artificial Intelligence, Management Science and Electronic Commerce, AIMSEC, 2011, art. no. 6010844, pp. 3059-3062.

[11] R.A. Valiyev, L.A. Galiullin, A.N. Iliukhin, "Design of the modern domain specific programming languages, " International Journal of Soft Computing, 10(5), pp. 340-343, 2015.

[12] Z.T. Yao, H.X. Pan, "Engine fault diagnosis based on improved BP neural network with conjugate gradient, " Applied Mechanics and Materials, 536-537, pp. 296-299, 2014.

[13] L. Guihang, W. Jian, W. Qiang, S. Jingui, "Application for diesel engine in fault diagnose based on fuzzy neural network and information fusion, " in Proc. IEEE 3rd International Conference on Communication Software and Networks, ICCSN, 2011, art. no. 6014398, pp. 102-105.

[14] X. Li, F. Yu, H. Jin, J. Liu, Z. Li, X. Zhang, "Simulation platform design for diesel engine fault, " in Proc. International Conference on Electrical and Control Engineering, ICECE, 2011, art. no. 6057562, pp. 4963-4967.

[15] M. Shah, V. Gaikwad, S. Lokhande, S. Borhade, "Fault indentification for I.C. engines using artifical nerual network, " in Proc. International Conference on Process Automation, Control and Computing, PACC 2011, art. no. 5978891.

[16] L.A. Galiullin, R.A. Valiev, "Automated system of engine tests on the basis of Bosch controllers, " International Journal of Applied Engineering Research, 10(24), pp. 44737-44742, 2015.

[17] R.A. Valiev, L.A. Galiullin, I.S. Dmitrieva, A.N. Ilyukhin, "Method for complex web applications design, " International Journal of Applied Engineering Research, 10(6), pp. 15123-15130, 2015.

[18] D. Wei, "Design of Web based expert system of electronic control engine fault diagnosis, " in Proc. BMEI, 2011, 1, art. no. 5916978, pp. 482-485.

[19] P.R.A. Valiyev, L.A. Galiullin, A.N. Iliukhin, "Approaches to organization of the software development, " International Journal of Soft Computing, 10(5), pp. 336-339, 2015.

[20] R.A. Valiyev, L.A. Galiullin, A.N. Iliukhin, "Methods of integration and execution of the code of modern programming languages, " International Journal of Soft Computing, 10(5), pp. 344-347, 2015.